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ABSTRACT

This exploratory study investigated whether the Brazelton Neonatal Behavioral Assessment Scale (NBAS) can predict an infant's behavior on mastery motivation tasks at 1 and 2 years of age. Subjects were 31 normal, full-term infants from white, mostly middle class families. Infants were assessed using the NBAS with Kansas Supplements (NBAS-K) at a mean age of 11.93 days. Seventeen of these infants participated in a mastery task session at a mean age of 24 months 23 days. When NBAS-K scores were correlated with later mastery scores, neonates judged to be difficult and willful were found to be more persistent, more competent, and to express relatively more task pleasure and less negative affect on the mastery tasks. These results are similar to studies that have shown socially valued neonatal behavior (e.g. alertness and consolability) to be negatively related to equally valued later behavior (e.g. competence). (MM)

The Brazelton Neonatal Assessment Scale as a Predictor of One- and Two-Year-Old Mastery Behavior

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ABSTRACT

The purpose of this exploratory study is to investigate whether the Brazelton Neonatal Behavioral Assessment Scale (NBAS) can be used to predict an infant's behavior on mastery motivation tasks at one and two years. Thirty one normal full term infants were assessed using the NBAS with Kansas Supplements (NBAS-K) at a mean age of 11.93 days. Seventeen of these infants were seen in a mastery task session at a mean age of 12 months 15 days, and twenty five were seen in a mastery task session at a mean age of 24 months 23 days. When NBAS-K scores were correlated with later mastery scores, neonates judged to "difficult/willful" were found to be more persistent, more competent, and to express relatively more task pleasure and less negative affect on the mastery tasks. These tentative results are similar to those of several other studies describing "inversions" between neonatal and later infant behavior. Those studies have shown socially valued neonatal behavior (e.g., alertness or consolability) to be negatively related to equally valued later behavior (e.g., competence).

INTRODUCTION

Purpose

The purpose of this exploratory study was to investigate whether the NBAS could be used to predict an infant's behavior on mastery tasks at one and two years.

The Brazelton Neonatal Behavioral Assessment Scale

The Brazelton Neonatal Behavioral Assessment Scale (NBAS) is an effective tool for assessing, both quantitatively and qualitatively, the individual characteristics of newborns (Self and Horowitz, 1979). The NBAS is divided into three areas: neurological intactness elicited through reflex testing; global dimensions of attractiveness, need for stimulation and interfering variables; and an interactional repertoire of behavioral items. These areas measure the newborn's ability to attend to and process simple and complex environmental events; maintain tone, control motor behavior, and perform integrated motor activities; maintain a calm, alert state despite increased stimulation; and respond and recover

from stress, and immaturity. Assessment of these areas make it possible to determine a newborn's capacities and abilities at a very young age. It is also possible to assess the infant's individual abilities and style of interaction with the environment.

The NBAS has been rated poorly as a predictor of later functioning by some authors and of high predictive validity by others (Als, 1978). The differences in predictive power among these studies may be attributable to differences among samples with some studies including abnormal infants (e.g., low birth weight) - thus increasing their predicative powers.

Mastery Motivation

There are two aspects to mastery motivation. First, mastery motivation is a psychological force that stimulates action. A child high in mastery motivation attempts, in a focused and persistent manner, to solve a problem or master a skill or task which is initially at least moderately challenging for him or her. The second aspect of mastery motivation is that it produces a positive affective feeling in the child while he or she is mastering a task. This pleasure may or may not be overtly expressed and

assumes different meanings as the child develops (Barrett and Morgan, in press).

A preliminary analysis indicated that NBAS variables were correlated with mastery behaviors at 12 months (Johnson, Morgan, Culp and Yang, 1992). The relation described an "easy" newborn who later exhibited low persistence, little pleasure, and long solution times in a mastery task. This ostensible "inversion" of socially preferred behaviors had been described by others, most notably, Bell, Weller and Waldrop (1971). However, their inversion (specifically labeled "intensity") occurred between birth and two years.

In this study, we report new born, 12-month, and 25-month relations on a small sample of clinically normal infants and toddlers. Our purpose was to determine if the relations described between behaviors at birth and 12-months continued through 25 months.

METHOD

Subjects

Thirty one normal (19 male and 12 female) full term infants from white, mostly middle class homes were assessed using the NBAS-K between 6 and 21 days in the first month of life with a mean age of 11.93 days. The infants were recruited for NBAS-K testing through mailings of pamphlets about the testing prepared by the Colorado State University Infant Laboratories to parents listed in the birth announcements in the local newspaper, and through word of mouth by parents of previously tested infants, the NBAS-K testers and health professionals familiar with the testing. Seventeen of these infants (10 male and 7 female) were seen in a mastery task session between 10 months 25 days to 13 months 7 days with a mean age of 12 months 15 days, and twenty five (17 male and 8 female) of the infants were seen again in a mastery session between 23 months 3 days to 28 months 12 days with a mean age of 24 months 23 days. The infants were recruited for study from the NBAS-K files maintained in the CSU Infant Laboratories. The infants were part of a larger mastery motivation study

of 9-, 12-, and 25-month-old children, looking at the development of a child's persistence at tasks and factors influencing this development. Only 12-month and 25-month-old data were used in this study.

NBAS-K Procedures

All the infants were delivered at Poudre Valley Hospital in Fort Collins, Colorado from January 1979 to July 1979. Twenty eight of the infants were tested in their homes and three were tested in the Infant Laboratory at CSU. All infants were tested using the NBAS-K (see Sullivan, 1977, and Horowitz, et al. 1978) and scored according to its protocols. Seven examiners were involved in the assessments, one certified NBAS-K tester supervising six trainees. Intertester reliability for the examiners, taken from eleven comparisons of reliability, ranged between 83% and 97%, with a mean of 89.8%.

NBAS-K Scores

The individual item scores from the NBAS-K were clustered in the following manner:

LABILITY of STATE was scored by counting the number of state changes an infant goes through during the examination. Low scores meant few state changes during testing, high scores meant frequent state changes.

CUDDLINESS was scored by rating the infant's cuddliness while being held in the examiner's arms or upon the examiner's shoulder during testing. Low scores were given to non-cuddly infants while high scores were given to cuddly infants.

EASY/PASSIVE NEONATE COMPOSITE was scored by combining the following: Alertness, Nonirritability, and Best Consolability

ALERTNESS was scored by combining the following NBAS-K scores: alertness, quality of infant's responsiveness and examiner persistence. Low scores meant low levels of alertness while high scores meant high levels of alertness.

NONIRRITABILITY was scored by combining peak of excitement, rapidity of buildup, irritability and general irritability from the NBAS-K and then subtracting the total from 36 (the highest possible score for irritability). A low score meant high irritability, a high score meant low irritability.

CONSOLABILITY was scored by combining the infant's best score for consolability with the characteristic or modal score for consolability during testing. A high score indicated an easily consolable infant, while a low score indicated difficulty in consoling the infant.

REFLEXES reflected very low ("Hypo") or high ("Hyper") scores on reflex testing. A high score would be considered undesirable.

Mastery Motivation Procedures

At each age the infants were tested with structured mastery motivation tasks. The tasks used in the study are

summarized in Table 1. **At 12 months,** the infants were seated on their mothers' laps at a table with the experimenter seated directly across from them. The mothers were instructed not to help their babies with any of the tasks. The tasks were adapted from previous mastery motivation studies (Yarrow, et al., 1982, and Yarrow, et al., 1983). The tasks included; combinatorial tasks (e.g. shape sorter); cause and effect tasks (e.g. surprise box); means-ends tasks (e.g. locks, barriers); symbolic tasks (e.g. telephone, doll, cup and spoon).

At 12 months the infants were first presented with a shape sorter, which provided a variety of opportunities for task-directed behaviors but was very difficult complete. The infants were then presented with eight additional tasks, which included two each of combinatorial tasks, cause-effect tasks, means-ends tasks, and symbolic tasks. The experimenter first demonstrated to the infant how to use part of the toy. The infant was then allowed to explore the toy for 2 or 3 minutes depending on the task. After a specified period of time the infants was verbally prompted or shown other appropriate solutions.

At 25 months, four sets of tasks were used: two combinatorial sets, one cause-

Table 1 Structured Mastery Tasks Used at Each Age

	AGE	
	12 Months	25 Months
Combinatorial Tasks (e.g., shape sorter, puzzle)	3	2 Easy 2 Hard
Cause-Effect Tasks (e.g., surprise box, cash register)	2	1 Easy 1 Hard
Means-End Tasks (e.g., locks, barriers)	2	1 Easy 1 Hard
Symbolic Tasks (e.g., phone, cup)	2	

and-effect set, and one set of means-end, barrier problems. Each set consisted of one task that was easy, one that was moderately difficult, and one that was difficult for a typical two-year-old. The task presumed to be moderately difficult was always presented first. If the child completed half or more of this task, he or she was then given the more difficult task. If not, the relatively easy task was presented. Each child received eight tasks, two from each set, based on the child's performance. This procedure adjusted the average difficulty level of the tasks to the competence of the child.

The tasks were presented to the child in much the same manner as the tasks presented at 12 months: interaction of the tester (and the mother) with the child was minimized except for the standardized demonstrations and prompts.

Mastery Motivation Scores

At 12 months, the following scores were derived from the mastery data:

TASK PERSISTENCE was scored by totaling the number of intervals in the nine mastery tasks during which the infant was observed to

be engaged in task-related behavior.

NEGATIVE AFFECT was scored by totaling the number of intervals when the infant was observed to express negative affect.

RELATIVE TASK PLEASURE was scored by dividing task pleasure by the combined task pleasure and negative affect scores (i.e., all expressed affect).

SHORT LATENCY to OWN SOLUTION was scored by reversing the sign of the number of intervals between the presentation of the task and the infant using it in an appropriate way not demonstrated by the experimenter during each of the nine tasks. This is one measure of the child's competence at the task.

At 25 months, the following scores were derived:

TASK PERSISTENCE was scored by totaling the number of 15 second intervals during the eight mastery task sets when the infant

was observed to be engaged in task-directed behavior.

TASK PLEASURE was scored by totaling the number of intervals of positive affect shown by the infant during task-directed behavior.

TASK COMPETENCE was scored by totaling the number of different parts of the task completed by the infant.

RESULTS

Intercorrelations of NBAS-K Scores

Table 2 shows that lability of state was negatively correlated with alertness, nonirritability, and the easy/passive neonate composite. Conversely, infants with few state changes during NBAS-K assessment showed little irritability and were passively alert during testing. Alertness, nonirritability, and consolability were, of course, correlated with the easy/passive neonate composite, of which they form a part.

Intercorrelations of Mastery Task Scores

Table 3 shows that at 12 months, task persistence was positively correlated with competence (short latency to solution). At 25 months, task persistence and task competence were again positively correlated as were task pleasure and task competence. However, task persistence and task pleasure were not significantly correlated at either age. Table 3 also shows that task competence was stable across 13 months. Figure 1, based on a larger sample (some subjects without NBAS-K Scores) shows that task pleasure

Table 2 Intercorrelations of NBAS-K Scores

	Cuddliness	Easy/Passive Neonate Composite	Alertness	Nonirritability	Consolability
Lability of State	.14	-.67**	-.34	-.77**	-.09
Cuddliness	--	-.19	.09	-.12	-.15
Passive/Easy Neonate Composite		--	.79**	.77**	.39*
Alertness			--	.33	.23
Nonirritability				--	-.00
Consolability					--

* $p \leq .05$, one tailed

** $p \leq .01$, one tailed

Table 3 Intercorrelations of Mastery Task Scores

	Task Persistence	Task Pleasure	Task Competence
Task Persistence	.45	.33	.54*
Task Pleasure[a]	.30	.27	.38
Task Competence[b]	.77**	.40*	.68*

* $p \leq .05$, one tailed

** $p \leq .01$, one tailed

Note. Intercorrelations at 12 months are above the diagonal; those at 25 months are below, and longitudinal relationships are on the diagonal. N = 16 at 12 months; N = 25 at 25 months; and N = 11 from 12 to 25 months.

[a] Relative Task Pleasure at 12 months

[b] Short latency to own solution at 12 months

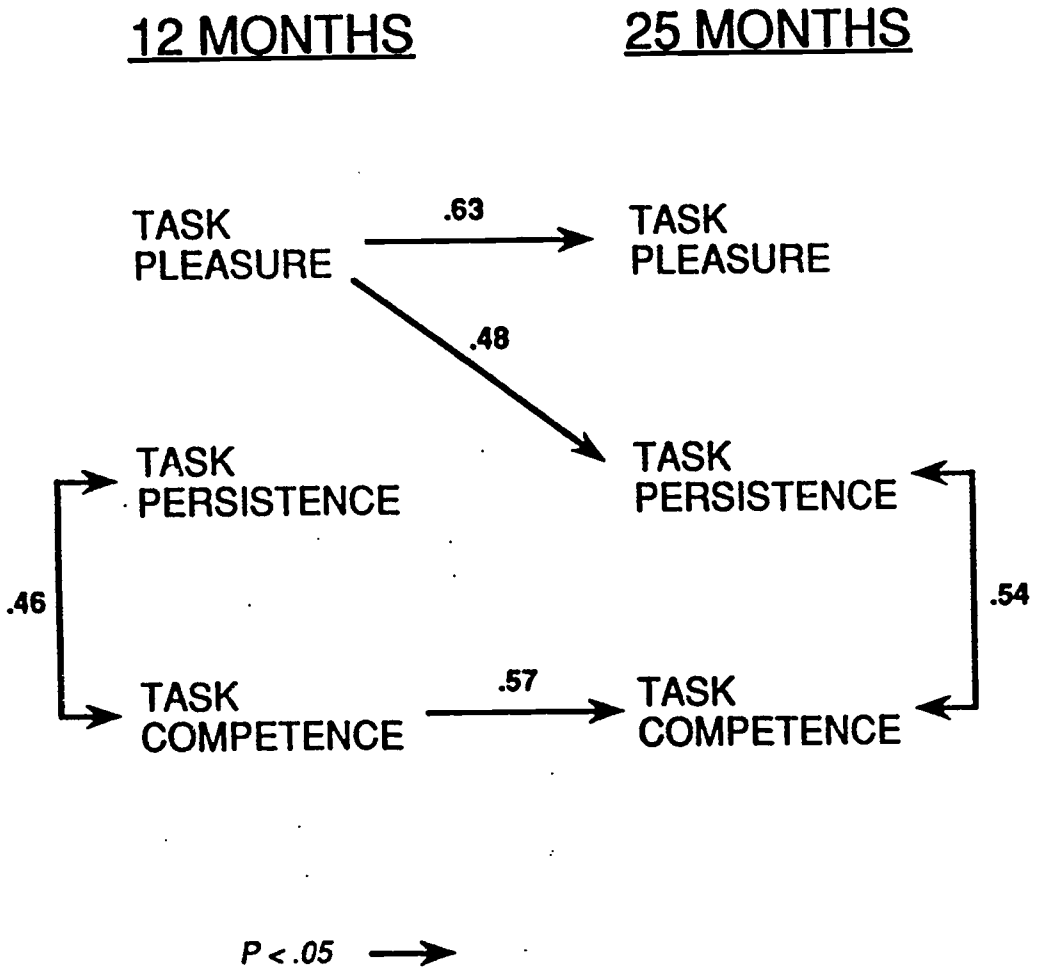

Figure 1. Intercorrelations and Stability of Two Measures of Mastery Motivation (Task Pleasure and Persistence) and Competence at 18 and 25 months.

was also stable over time, but task persistence was not.

Relationships between NBAS-K Data and Mastery Tasks at 12 Months

Newborns who were more cuddly during NBAS-K testing had shorter latencies to solution on the 12-month mastery tasks ($r = .57$, $p < .05$). Infants found to be more alert during the NBAS-K testing showed more negative and relatively less positive affect in the mastery session ($r = -.54$, $p < .05$). Nonirritable newborns tended to express more positive and negative affect during the mastery session. Infants that were found to be easy to console during NBAS-K testing tended to have longer latency to solution, i.e. lower task competence.

By combining the scores for alertness, nonirritability and best consolability from the NBAS-K, a composite was formed to describe a easy/passive neonate. Conversely, a difficult/willful infant was one that was not alert, was somewhat irritable and harder to console during testing. It might be expected that easy/passive neonates, would be more persistent and more responsive on mastery tasks. However, Table 4 shows that correlations of NBAS-K data with the mastery scores reveal

Table 4 Correlations of Neonatal Scores with Mastery Task Scores at 12- and 25-months of Age

	Easy/Passive Neonate Composite[c]	"Hypo or Hyper" Reflexes
Task Persistence		
12 Months	-.36*	.10
25 Months	-.23	-.39**
Task Pleasure		
12 Months[a]	-.52**	-.46**
25 months	-.27	-.16
Task Competence		
12 Months[b]	-.43**	-.03
25 Months	-.33*	-.47**

* $p \leq .10$, one tailed

** $p \leq .05$, one tailed

[a] Task pleasure relative to all affect

[b] Short latency to own solution

[c] Composite of easily consolable, nonirritable, and alert

that easy/passive neonates tended to be less persistent, expressed relatively less task pleasure, and tended to be less competent on the mastery tasks a year later.

Relationships between NBAS-K Data and Mastery Tasks at 25 Months

Table 4 also shows the easy/passive neonates were still somewhat less persistent and competent and tended to show less pleasure while working on mastery tasks at 25 months. These results were, however, less clear and generally not significant.

Table 4 also shows the correlations between the number of "hypo or hyper" reflexes and the mastery task scores at 12 and 25 months. As might be expected clinically, there were several significant correlations with later behavior; at 12-months relative task pleasure and at 25-months task persistence and task competence were related to a low number of "hypo or hyper" reflexes.

DISCUSSION

The results indicate that easier, perhaps passive, neonates were less task persistent one and two years later, showed more negative affect and less relative task pleasure, and were less competent at the mastery tasks. More difficult, perhaps willful, neonates, that is, those who were less alert, more irritable, more difficult to console and had more lability of state, showed more task persistence later, less negative affect and more relative task pleasure, and more competence at tasks.

This "inversion", while controversial (cf Bell, Weller, and Waldrop, 1971; Yang and Halverson, 1976), has continued to appear in the literature. Moss, Colombo, Mitchell, and Horowitz (1988) suggested that neonatal sensitivity to endogenous stimuli might reflect survival value; such sensitivity might be displayed via state variation and irritability. Once endogenous stability has been achieved (by the end of the neonatal period), the infant could shift to exogenous sensitivity (e.g., visual habituation). DiPietro and Porges (1991) demonstrated that irritability, low alertness, and state lability were positively correlated with later maturity, suggesting that neonatal irritability may reflect sensitivity to important internal stimuli.

As important, these neonatal

behaviors may be significant in the caregiving environment. An irritable, less attentive and less easily consolable neonate may control and demand ministration from the caregiver. In contrast, an easily consolable, alert baby who has few state changes may allow the caregiver more easy-going and emotionally positive exchanges with the neonate; indeed, the caregiver may dominate the interaction and be inattentive to ignore the baby. These early caregiver/infant exchanges could establish a pattern in which the difficult (i.e., non-easy) infant demands and receives more from the caregiver. These distinctive exchanges, emerging early and differing by initiator and emotional tone, could presage later patterns of interaction.

This is what Biringen, Emde, Campos, and Applebaum (1993) found when they observed mother/infant interaction as infants were just starting to walk. Early walkers were more willful and negative than late walkers when interacting with their mothers. They found that temperament differences existed between the early and late walkers, with early walkers displaying more frustration and distress. However, in spite of these negative initial exchanges, early walkers became more positive than late walkers as they made the transition to full walking.

If walking can be defined as an

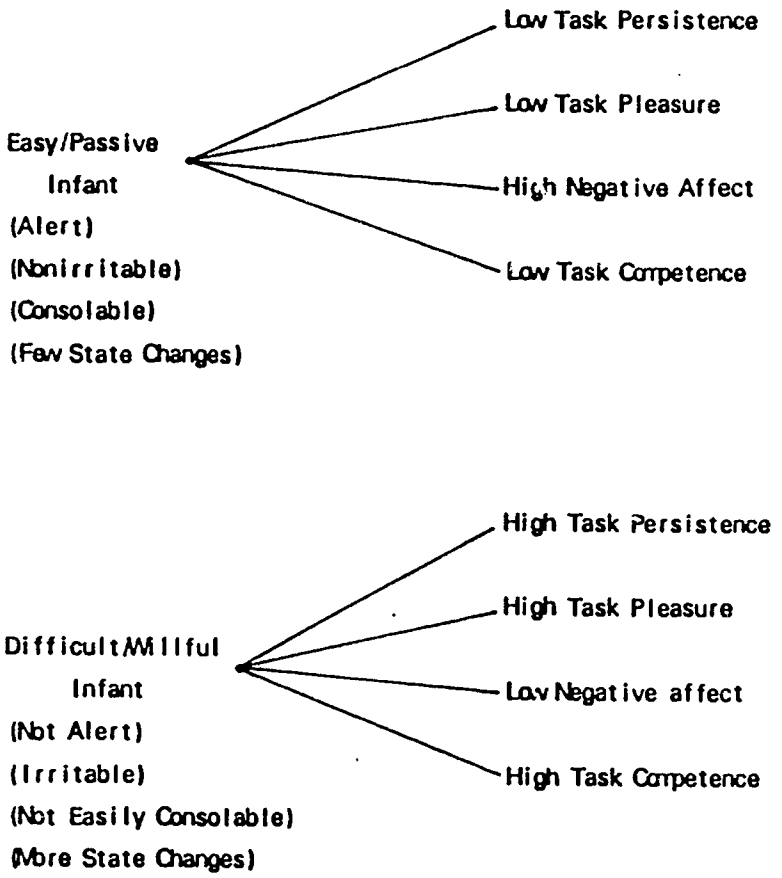

Figure 2 Schematic of an "Inversion" from Birth to Two Years

important mastery task, the negatively toned interaction between early walkers and their caregivers is informative. It seems possible that as an early temperamental characteristic, neonatal irritability and inconsolability, as well as later negativity, impatience, and willfulness, shape the environment to meet the infant's needs --- which, when couched in negative tones, can be defined as "demands." Nevertheless, these early needs may be functional. For example, grasping, crawling, and walking are early mastery tasks confronting the infant. Greatest control over the environment supportive of those tasks may occur when the infant can create a negatively toned interaction with the caregiver (i.e., Biringen, et al, 1993); competence may emerge first among these infants. The inversion that we and others have found reflects, therefore, the infant's ability to control effectively the competence-relevant environment: difficult infants possess that control; easy infants do not.

As a final note, we would like to describe two curious findings. The first describes a statistically significant negative correlation between age of the father and our measures of mastery at 12- and 25-months. We mention this finding because the same relationship for fathers age emerged in the Biringen, et al (1993) study. The second finding describes a statistically significant

negative correlation between birth weight (all infants were full term) and measures of mastery at 12- and 25-months of age. Clinically normal but smaller babies later performed more competently. We are uncertain how to interpret these findings.

The small sample size and marginal statistical significance of the correlations make tentative any conclusions from this study. However, most of the correlations between neonatal "difficultness" and mastery behaviors were consistent with an "inversion" interpretation.

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